2814

JBH:jjv 07/11/01 6047-55230

PATENT
Attorney Reference No. 6047-55230

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Gilton et al.

Art Unit: 2814

Application No. 09/579,345

Filed: May 25, 2000

For: SEMICONDUCTOR FABRICATION METHODS AND APPARATUS

Examiner: S. Rao

Date: July 11, 2001

CERTIFICATE OF MAILING

I hereby certify that this paper and the documents referred to as being attached or enclosed herewith are being deposited with the United States Postal Service on July 11, 2001, as First Class Mail in an envelope addressed to: BOX NON-FEE AMENDMENT, COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

Jeffrey B. Haendler, Esq.
Attorney for Applicant

TRANSMITTAL LETTER

BOX NON-FEE AMENDMENT
COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Enclosed is an Amendment for the above application. The fee has been calculated as shown below.

CLAIMS AS AMENDED

For	No. after amendment	No. paid for previously		Present Extra	Rate	Fee
Total Claims	38	- 38*	=	0	$18.00	$ 0.00
Indep. Claims	12	12**	=	0	$80.00	$ 0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT						$ 0.00

* greater of twenty or number for which fee has been paid.
** greater of three or number for which fee has been paid.

☒ No additional fee is required.

☒ Please charge any additional fees that may be required in connection with filing this amendment and any extension of time, or credit any overpayment, to Deposit Account No. 02-4550. A copy of this sheet is enclosed.

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☒ Please return the enclosed postcard to confirm that the items listed above have been received.

Respectfully submitted,

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Attorney for Applicant

#8
Response
FJONES
7-24-01

COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

RESPONSE

This is in response to the Office Action dated May 9, 2001.

REMARKS

Claims 14-15, 20-25, 31 and 37 are pending in the application.

I. Double Patenting Rejection

Claims 14-15, 20-25, 31 and 37 are rejected under the doctrine of double-patenting of the obviousness-type as allegedly being unpatentable over claims 1 and 2 of U.S. Patent No. 5,785,875 to Hawthorne (Hawthorne). Applicants traverse this rejection.

The Examiner contends that "[c]laims 14-15, 20-25, 31 and 37 are directed to an invention not patentably distinct from claims 1 and 2 of commonly assigned patent 5,785,875" because "applicants' vaporizing liquid can be water *as specified in the '875 patent* and the applicnat's [sic] reactant gas can be isopropyl alcohol as specified in "875 [sic] patent claim 2." (Office action, p. 2; emphasis added). Applicants disagree.

First, claim 1 of Hawthorne recites etching a film on the surface of a wafer and as such, there is no teaching or suggestion for the use of water (water by itself is not an etching agent). Moreover, an obvious-type double-patenting rejection must be based on the invention as defined in the claims of the issued patent. The disclosure of the patent may not be used as prior art. *See* MPEP § 804, p. 800-18.

The Examiner improperly cites the specification of Hawthorne to support the double-patenting rejection (see italicized language in the previous paragraph).

The Examiner also contends that it would have been obvious to use ozone gas, such as is recited in claims 24 and 37 of the present application. For support, the Examiner cites Iimuro et al., Japanese Patent Publication No. 1-239933 (Iimuro). This contention is incorrect. Applicants' point out that if the disclosure of the commonly assigned patent cannot be used as prior art to support a double patenting rejection, then certainly a completely unrelated patent (i.e., a patent owned by an unrelated entity) cannot be used.

Further reasons as to why the claims of the present application are patentable over Hawthorne and Iimuro are provided below.

II. Rejection of Claims 14-15, 20-25, 31 and 37 Under § 103(a)

1. The Present Claims are Patentable Over Hawthorne

Claims 14-15, 20-23, 25 and 31 are rejected under 35 U.S.C. 103(a) as allegedly being obvious in view of Hawthorne. Applicants traverse the rejection.

With respect to claim 14, Hawthorne neither teaches nor suggests a method for semiconductor wafer fabrication that includes (1) "vaporizing a liquid solvent that is inert to a material on the surface of a wafer" or (2) "selecting a reactant gas that is capable of chemically reacting with the material on the surface of the wafer" or (3) "incorporating the reactant gas into the vaporized liquid solvent" or(4) "condensing the vaporized solvent incorporating the reactant gas to form a film on the surface of the wafer so that the reactant gas is transported through the film to the material on the surface of the wafer." Basically, Hawthorne is totally irrelevant as it neither teaches nor suggests even a single element of claim 14.

More particularly, the Examiner contends that Hawthorne describes "vaporizing a liquid solvent that is inert to A [sic] material on the wafer surface" at col. 4, line 62 and col. 5, lines 11-14 of Hawthorne. This contention is incorrect. In short, Hawthorne discloses a method for etching wafers and removing photoresist material from the wafers after the etching process using an alcohol solvent. Beginning at col. 4, line 62, Hawthorne discloses filling a chamber 10 with liquid water along with an etching agent to etch the film on the surface of the wafers in the chamber. This water/etching agent solution is not vaporized nor is it inert to the film on the surface of the wafers. Claim 14, on the other hand, recites *vaporizing* a liquid solvent that is *inert* to a material on the wafer surface. For this reason alone, claim 14 is allowable over Hawthorne.

As mentioned above, the Examiner also cites col. 5, lines 11-14 of Hawthorne as describing "vaporizing a liquid solvent that is inert to A [sic] material on the wafer surface." Again, the Examiner's contention is incorrect. This portion of the Hawthorne specification discloses exposing wafers in the chamber to a heated solvent vapor to strip the photoresist material from the wafers. Hawthorne further provides that the "solvent can be any substance capable of solubilizing and dispersing photoresist material when heated and vaporized, though isopropyl alcohol is preferred." (See col. 5, lines 24-27). This solvent is further described at col. 5, lines 65-67 through col. 6, lines 1-5 of Hawthorne. Although not entirely clear from the Office Action, it appears that the Examiner is citing this portion (col. 5, lines 65-67 through col. 6, lines 1-5) of Hawthorne as describing "selecting a reactant gas that is capable of chemically reacting with the material on the wafer surface and incorporating the reactant gas into the vaporized liquid solvent."

To establish obviousness of a claim, each limitation of the claim must be taught or suggested by the prior art. MPEP § 2143.03, p. 2100-100 (citing In re Royka, 490 F.2d 981 (CCPA 1974)). Thus, if it is the Examiner's contention that vaporizing alcohol as taught by Hawthorne is equivalent to "vaporizing a liquid solvent that is inert to A [sic] material on the wafer surface" in claim 14, then it cannot be equivalent to "selecting a reactant gas that is capable of chemically reacting with the material on the wafer surface" which also is required by claim 14. Conversely, if it is the Examiner's contention that vaporizing alcohol as taught by Hawthorne is equivalent to "selecting a reactant gas that is capable of chemically reacting with the material on the wafer surface" in claim 14, then it cannot be equivalent to "vaporizing a liquid solvent that is inert to A [sic] material on the wafer surface" in claim 14. In other words, the vaporized solvent of Hawthorne cannot satisfy both of these requirements of claim 14.

In addition, since Hawthorne does not teach or suggest a reactant gas or a vaporized liquid solvent, Hawthorne necessarily does not teach or suggest "incorporating the reactant gas into the vaporized liquid solvent."

The Examiner also contends that Hawthorne discloses "condensing the vaporized solvent incorporating the reactant gas to form a film on the surface" as recited in claim 14. Again, this contention is incorrect. For support of this position, the Examiner cites col. 5, lines 33-36 of Hawthorne, which provides, in part: "a thin layer of liquid solvent typically forms above the hydrous material and etching agent." However, since the water/etching agent liquid solution taught by Hawthorne is not vaporized, the solution is not later "condensed."

Further, Hawthorne does not teach or suggest transporting a gas through a liquid film on the surface of a wafer to contact a material on the surface thereof, as recited in claim 14. The vaporized

alcohol solvent of Hawthorne, which the Examiner claims to be a "reactant gas" equivalent to that recited in applicants' claim 14 (which is incorrect), forms a "layer of liquid solvent above the hydrous material and etching agent." Thus, assuming for argument sake that the alcohol solvent is transported through the hydrous material to the wafer surface (although there is no teaching or suggestion in Hawthorne that this is the case), it would have to do so as a liquid, not as a gas, as recited in claim 14.

For at least these reasons, applicants' method as set out in claim 14 clearly is not rendered obvious by Hawthorne and is allowable.

Claim 15 depends directly from claim 14 and is allowable for the reasons given above in support claim 14 and because it sets forth an independently patentable combination of features. Specifically, unlike any teaching or suggestion in the prior art, the claim 15 method recites "flowing the reactant gas over the film such that some of the flowing reactant gas is transported through the film to the surface of the wafer." (See the discussion below in relation to claim 20.)

With respect to claim 20 and without limitation, Hawthorne does not teach or suggest "flowing a wafer cleaning gas over the liquid layer [on the surface of a wafer] such that some of the flowing gas is transported through the liquid to the surface of the wafer."

The Examiner contends that Hawthorne describes "flowing a wafer cleaning gas over the liquid layer so that some of flowing gas [sic] is transported through the liquid to the surface of the wafer" at col. 5, lines 54-65. This is incorrect. The cited portion of Hawthorne suggests using a chemical cleaning step and a rinsing and drying step (which includes flowing further hot solvent), after the solubilized photoresist is drained off the surfaces of the wafers, such as by gravity or positive pressure applied to the chamber (see col. 5, lines 39-54). These steps are performed sequentially. In other words, in Hawthorne, the fluid used in the chemical cleaning step is drained off the wafers before the wafers are rinsed and the fluid used to rinse the wafers is drained off the surface of the wafers before the wafers are dried with vapor solvent. At best, Hawthorne teaches flowing a vapor solvent over the surfaces of wafers, however, there is no support for the contention that a liquid layer is present on the surface of the wafer when the vapor solvent passes over the wafer or that the vapor solvent is transported through a liquid layer on the wafer surface.

In addition, as explained above with respect to claim 14, in Hawthorne, the first application of vaporized alcohol solvent (to remove photoresist) forms a "layer of liquid solvent above the hydrous material and etching agent." Again, even assuming that the alcohol solvent is transported through the hydrous material to the wafer surface (we repeat that there is no teaching or suggestion that this is true), it would have to do so as a liquid, not as a gas.

For these reasons,claim 20 is patentable over Hawthorne.

Claims 21-25 depend directly from claim 20 and are allowable for the reasons given above in support of claim 20 and because each claim sets forth an independently patentable combination of features.

For example, claim 21 recites that the liquid is a solvent for the cleaning gas. The Examiner contends that at col. 5, line 65 through col. 6, line 6 in Hawthorne, a method is taught wherein a liquid is used as a solvent for a cleaning gas. Applicants' fail to appreciate any relevance of this passage cited by the Examiner in support of the rejection of claim 21. This portion of the specification discusses the advantages of using hot vapor solvent. Also, as explained above, Hawthorne teaches introducing each fluid into the chamber sequentially, after a previous fluid is drained off the wafer surfaces. There is no teaching or suggestion in the cited passage or elsewhere in the Hawthorne patent for the use of any other fluids in combination with the hot vapor solvent, let alone the use of a liquid that serves as a solvent for a cleaning gas.

In addition, claim 25 recites that the liquid solvent is inert to the material on the surface of the wafer. The Examiner contends that the inert liquid solvent in Hawthorne is water. On the contrary, the method described in Hawthorne does not include the use of water. Instead, the method includes the use of a water/etching agent solution that etches the surface of the wafer. Clearly, an etching solution is not an insert liquid solvent.

Claim 31, like claim 14, includes selecting a gas capable of reacting with a material on a wafer surface and incorporating the reactant gas in a liquid solvent that is inert to the material on the wafer surface. As explained above with respect to claim 14, Hawthorne does not teach or suggest selecting a gas capable of reacting with a material on a wafer surface or incorporating the reactant gas in a liquid solvent that is inert to the material on the wafer surface. Accordingly, claim 31 is allowable over the references of record.

2. The Present Claims are Patentable over Hawthorne and Iimuro

Claims 24 and 37 are rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Hawthorne and Iimuro. Applicants' traverse the rejection.

Claim 24 depends directly from claim 20 and is allowable for the reasons given above in support of claim 14 and because it sets forth an independently combination of features.

For example, claim 24 recites that the cleaning gas is ozone. The Examiner contends that "it would be obvious to one of ordinary skill in the art at the time of the invention to include Iimuro's ozone

as the cleaning gas in Hawthorne's cleaning gas to speed up the treatment (cleaning) process." Applicants disagree.

Iimuro teaches an ashing gas method. Specifically, Iimuro teaches mixing ozone with water vapor in a gas/liquid mixing vessel 12 that is separated from the wafer 3 (Fig. 1, Constitution). The ozone/water vapor mixture is then passed through a supply tube 9a to flow toward a surface of the wafer 3. There is no indication in Iimuro nor does the Examiner contend that a layer of liquid is formed on the wafer surface. In fact, Iimuro, unlike applicants' invention, teaches heating a wafer to remove fluid deposited on the wafer surface (Constitution).

Additionally, Hawthorne was designed to avoid the disadvantages associated with photoresist ashing. (see col. 1, lines 46-57 of Hawthorne). Because Hawthorne teaches away from the photoresist ashing of Iimuro, one of ordinary skill in the art would have no incentive to look to Iimuro to make up for the deficiencies in Hawthorne. Here, the only motivation to combine the cited patents has come from applicants' disclosure. Only with hindsight knowledge of applicants' invention, which cannot be used, would one of ordinary skill in the art be led to replace the vapor solvent in Hawthorne with ozone.

A claimed invention is not suggested by prior art that would lead away from the claimed invention. MPEP § 2141.02, p. 2100-95 (citing W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1450 (Fed. Cir. 1983)). In the present case, Iimuro teaches away from the claimed invention in that it teaches removing fluid from the wafer instead of forming a layer of liquid on the wafer (as recited in claim 24). Therefore, Iimuro is not properly combinable with Hawthorne and the rejection must be withdrawn.

Claim 24 is allowable over the art of record.

Claim 37, like claim 24, recites the use of ozone gas. As already explained in connection with claim 24, the ozone gas of Iimuro cannot be properly combined with the Hawthorne method to provide applicants' invention as Iimuro teaches away from both the claimed invention, as well as from the teachings of Hawthorne. Thus, claim 37 is allowable over Hawthorne and Iimuro.

III. Conclusion

For the foregoing reasons, the claims of the present application are in condition for allowance and early notification to that effect is respectfully requested. If any further issues remain concerning the application, the Examiner is invited to call the undersigned to discuss such matters.

Respectfully submitted,

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